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# **SEFSC Coral Reef Program: FY 2014 Project Accomplishments Report**

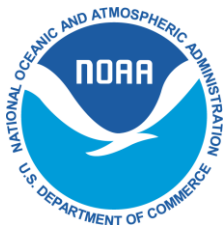
Compiled by:  
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National Marine Fisheries Service  
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October 2015





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October 2015

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*Cover photograph: A patch of bleached *Acropora palmata*, Grecian Rocks, Florida Keys, Sept. 11, 2014. Photo credit: Dana Williams, University of Miami/CIMAS*

# SEFSC Coral Reef Program: FY 2014 Project Accomplishments Report

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## LIST OF ACRONYMS

AOML	OAR's Atlantic Oceanographic and Meteorological Laboratory
BIRNM	Buck Island Reef National Monument
CCFHR	NCCOS - Center for Coastal Fisheries Habitat Research
CFMC	Caribbean Fishery Management Council
CIMAS	Cooperative Institute for Marine and Atmospheric Studies at UM-RSMAS
CoRIS	Coral Reef Information System
CRCP	Coral Reef Conservation Program
CREIOS	Coral Reef Ecosystem Integrated Observing System
DNER	Puerto Rico Department of Natural and Environmental Resources
DPNR	US Virgin Islands Department of Planning and Natural Resources
EEMP	St. Croix East End Marine Park
ESA	Endangered Species Act
FAU	Florida Atlantic University
FDEP	Florida Department of Environmental Protection
FKNMS	Florida Keys National Marine Sanctuary
FL	Florida
FSA	Reef Fish Spawning Aggregation
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
FY	Fiscal Year
GMFMC	Gulf of Mexico Fishery Management Council
HBOI	Harbor Branch Oceanographic Institute
LPI	Line Point Intercept
MPA	Marine Protected Area
NCCOS	NOS National Centers for Coastal Ocean Science
NCRMP	National Coral Reef Monitoring Plan
NMFS	NOAA's National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	NOAA's National Ocean Service
NPS	National Park Service
NSU	Nova Southeastern University
OAR	NOAA Oceanic and Atmospheric Research
OECA	Oculina Experimental Closed Area
PI	Principal Investigator
PR	Puerto Rico
QA/QC	Quality Assurance/Quality Control
R/V	Research Vessel
ROV	Remotely Operated Vehicle
RSMAS	University of Miami's Rosenstiel School of Marine and Atmospheric Science
RVC	Reef Visual Census
SAFMC	South Atlantic Fishery Management Council
SEAMAP-C	Southeast Area Monitoring and Assessment Program – US Caribbean
SEFCRI	Southeast Florida Coral Reef Initiative
SEFSC	Southeast Fishery Science Center
SERO	NMFS Southeast Regional Office
TNC	The Nature Conservancy
UM	University of Miami
UPR/UPR-M	University of Puerto Rico/University of Puerto Rico - Mayaguez
US	United States
USFWS	United States Fish and Wildlife Service
USVI	United States Virgin Islands
UVI	University of Virgin Islands

## I. INTRODUCTION

The NOAA Coral Reef Conservation Program (CRCP) is a matrix program operating across four NOAA line offices: National Ocean Service (NOS), National Marine Fisheries Service, National Environmental Satellite, Data, and Information Service, and Oceanic and Atmospheric Research and is administered by NOS. The program supports conservation of coral reef regions of the United States, has an international component, and is integrated with other federal agencies, states, territories and commonwealths, and local governments. The program has been operating under the still-in-use strategic guidance of the CRCP's 2010-2015 "goals and objectives".

The Southeast Fisheries Science Center has been a leader in coral reef conservation science since 1978. Congress passed the Coral Reef Conservation Act in 2000 and the SEFSC dovetailed its management-relevant coral reef science with the fledgling NOAA CRCP. SEFSC maintains a strong coral reef science program and continues to deliver high-caliber, peer-reviewed science in support of coral reef conservation and management and other National Marine Fisheries Service (NMFS) mandates to conserve the nation's fisheries, essential fish habitat, and protected species. Recent activities that have shaped the course of SEFSC's coral reef science program include the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (2006), which has drawn attention to data deficiencies for coral reef fisheries; the listing of 7 Atlantic corals (2 in 2006, 5 in 2014) as threatened under the Endangered Species Act (ESA); and the advent of the CRCP's National Coral Reef Monitoring Program (NCRMP) in 2013. NMFS plays a critical regulatory role to effect change on coral reefs.

In Fiscal Year 2014, CRCP supported 10 SEFSC-led projects totaling ~\$1.55M. While most projects addressed fishing impacts or the status and recovery of protected coral species, SEFSC also tackled projects looking at recreational fishing effort in the US Caribbean, and recovery of spawning aggregations both in Florida and the US Caribbean. New projects in 2014 included work on conch populations in the USVI and work describing spawning aggregations of reef fish in Puerto Rico. New three year cooperative agreements with the Fishery Management Councils went into place in 2014, and SEFSC continues to work with the South Atlantic Fishery Management Council to monitor effectiveness of Marine Protected Areas (MPAs) in the southeast U.S. Atlantic region. Two additional "completed" projects are included in this report that had significant accomplishments after their funding cycle ended.

2014 was a watershed year for corals. A catastrophic bleaching event occurred in summer/fall 2014 in Florida resulting in the loss of ~30% of SEFSC's monitored *Acropora palmata* colonies. Soon after, NOAA published its decision to list 20 of the 82 coral species under consideration as Threatened under the ESA. The Atlantic region now has 7 threatened corals in its jurisdiction and SEFSC is poised to apply lessons learned from 2006 listing to these newly listed corals. Our ongoing research and monitoring of threats and impacts to corals and the bottlenecks to their recovery continues to contribute "best scientific practices" to the conservation and management communities as we address *Acropora* recovery plan actions and provide the science behind the regulatory requirements for the newly listed corals.

The Agency is also paying closer attention to fisheries data deficiencies in the US territories that are hampering fisheries stock assessments. Through the "Territorial Science Initiative", NMFS is focusing resources on validating catch and effort and increasing capacity in age and growth studies in the US Caribbean. CRCP's contributions under NCRMP are also critical as the fish monitoring being done in the US territories may contribute to fishery independent indices that can improve stock assessment. In 2014, NCRMP fish and benthic monitoring were conducted in both Florida and Puerto Rico. SEFSC led the effort in Florida which achieved tremendous success in large part because of our longstanding collaborative partnership with the National Park Service and the Florida Fish and Wildlife Conservation Commission. Working together, we were able to achieve nearly 300% more effort than would have been possible with only NCRMP funds. SEFSC also rolled out a new on-line portal which significantly enhanced data entry, compilation, and quality control. Collectively, SEFSC's fish monitoring program has contributed information to stock assessment, MPA performance questions, and ESA listing petitions.

This annual accomplishments report provides information on the activities and accomplishments of SEFSC projects funded by the CRCP in FY14. SEFSC gratefully acknowledges funding support from NOAA's CRCP.

## II. PROGRAM COORDINATION

<b>Project ID#:</b>	1250-2014
<b>Title:</b>	SEFSC Coral Reef Conservation Program Coordination and Communication
<b>PIs and co-PIs:</b>	Jennifer Schull (SEFSC)
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Program Coordination

### **Brief description of activities conducted in FY2014**

This project provided program management for SEFSC's portfolio of coral reef related activities in FY14. It covered SEFSC participation in working groups, and coordination of SEFSC projects, budgets, accomplishments reporting, proposal development, and science communication. It ensured SEFSC participation in all CRCP related strategic planning initiatives and ensured all SEFSC activities were integrated with and communicated to the relevant management entities. This project supported SEFSC representation in NCRMP development and execution.

### **Description of accomplishments & results**

The Program Coordinator coordinated all SEFSC CRCP projects in FY14, including development of pre-proposals and full proposals, monitoring and executing budget and travel ceiling requirements, contracting and reporting for the approved projects. The Program Coordinator submitted updates to CRCP on project performance, accomplishments, and monitored SEFSC inputs into the Coral Reef Information System(CoRIS). The Program Coordinator cultivated strong working relationships with management partners, especially in the context of NCRMP which had its first implementation year in Florida. The Program Coordinator continued to represent SEFSC on CRCP issues concerning fishing impacts implementation planning, performance measures, data management, outreach and communications, and international activities. The Program Coordinator ensured planning documents were reviewed by subject matter experts, and coordinated grant reviews for several CRCP grant programs.

The Program Coordinator continues to integrate coral reef related activities with other NOAA and NMFS missions. This year, the Program Coordinator co-hosted a Fishery Independent Survey workshop in Miami, coordinated visits by Donna Wieting (Director, NMFS' Office of Protected Resources) and the Science Board, and helped plan and organize activities pertaining to the Office of Science &Technology "Territorial Science Initiative". The Program Coordinator worked with the Southeast Regional Office (SERO), Protected Resources and Sustainable Fisheries in support of the data requirements under the Reef Fish (parrotfish) Biological Opinion.

The Program Coordinator serves as the principal SEFSC point of contact for NCRMP, the CRCP's status and trends monitoring program, co-leading the Atlantic Biological Monitoring initiative. In November 2013, the Program Coordinator led a Florida Partners' meeting to discuss the implications of establishing NCRMP in Florida, including a discussion of the results of an efficiency analysis project conducted by partners at the University of Miami, Rosenstiel School of Marine and Atmospheric Science (RSMAS) via an NCRMP grant. New partners were integrated into the NCRMP framework, including The Nature Conservancy's (TNC's) Florida Reef Resilience Program and Nova Southeastern University's (NSU's)



benthic ecology team (Dr. Steven Miller). The Program Coordinator ensured NCRMP was substantially communicated with regional partners including the National Park Service (NPS), Florida Fish and Wildlife Conservation Commission (FWC), Florida DEP, state parks, Florida Keys National Marine Sanctuary (FKNMS), and US Fish and Wildlife Service (USFWS). For the first NCRMP monitoring in Puerto Rico, the Program Manager participated in a planning meeting with regional partners in February 2014 and helped with the planning, logistics, and leverage for implementing NCRMP in Puerto Rico.

The Program Coordinator continued to enhance communications and collaborations related to coral reef science issues. A joint Atlantic Oceanographic and Meteorological Laboratory (AOML)/SEFSC coral reef PI meeting was held to increase collaboration, cross train, and develop proposals, and coordination was conducted to enhance SEFSC's ESA coral work under the new 2014 listing of 5 additional Atlantic coral species under the ESA. Quarterly calls were instituted with SEFSC coral reef PIs, and many "science stories" and science seminars highlighting CRCP activities were drafted for a variety of internal and external audiences. Two very successful seminars were Dr. Steven Smith's seminar on sampling efficiency analysis that set the stage for decoupled fish and benthic NCRMP surveys in Florida, and Dr. Tom Adam's seminars on the behavior and ecology of Atlantic parrotfish species.

#### **How project supports goals & objectives of CRCP**

This project ensures that the SEFSC is fully engaged in CRCP-related programs and generates projects and outputs aligned with the goals and objectives of the CRCP. This project ensures SEFSC's projects meet the needs of the coral reef management community, and provides leadership support for SEFSC's role in NCRMP. It ensures that SEFSC PI's are responsive to CRCP needs and that SEFSC speaks with one voice. This project ensures that SEFSC's coral-related activities are communicated to a wide variety of audiences.

#### **How project supports management of coral reef resources**

This project guides development of coral-related projects that will have meaningful impacts on the conservation and management of coral reefs. It synthesizes the expert advice and scientific outputs of SEFSC coral reef related projects for incorporation into scientifically sound management actions. It integrates CRCP-related outputs with those from other NMFS activities related to habitat, sustainable fisheries, and protected species. It also integrates SEFSC's coral reef activities with other NOAA and NMFS engagement nationally and internationally such as NOAA in the Caribbean and the NOAA Caribbean Strategy.

#### **List of project partners and their roles**

None

#### **Communications, media exposure, capacity building, education and outreach activities**

- Published FY13 accomplishment Report as a Technical Memorandum (see below)
- Led Florida Partners' Meeting, November 2013
- Puerto Rico NCRMP Planning Meetings, February 2014 (9 meetings over 3 days)
- Presented NCRMP to USFWS National Dive Program meeting in Crystal River, FL, April 2014
- Hosted SEFSC/AOML collaboration meeting, May 2014
- Florida Coral Reef Manager's Meeting, May 2014
- Provided content for CRCP's 2014 Report to Congress
- Co-hosted Fishery Independent Survey Workshop, September 2014
- SEFSC and CRCP Science Stories

- Ongoing informal communications with regional partners

**Submissions to CoRIS**

See below

**FY2014 Publications**

NOAA Coral Reef Conservation Program National Coral Reef Monitoring Plan (2014).

SEFSC Coral Reef Program: FY2013 Project Accomplishment Report. Compiled by Jennifer Schull. NOAA Technical Memorandum. NMFS-SEFSC-663, 40p

**FY2014 Presentations**

Schull, J. The Coral Reef Conservation Program's National Coral Reef Monitoring Plan. November 2013. Florida Reef Fish Visual Survey Partners' Meeting. Miami, Florida.

Schull, J. The Coral Reef Conservation Program's National Coral Reef Monitoring Plan. May 2014. AOML/SEFSC Science Meeting. Miami, Florida.

Schull, J. NOAA NCRMP - The Coral Reef Conservation Program's National Coral Reef Monitoring Plan. April 2014. USFWS Annual Diver Training and Recertification Meeting. Crystal River, FL.

**Setbacks or challenges encountered in FY2014**

None

**Comments on future direction of project**

This project is expected to continue providing valuable oversight and coordination of SEFSC's coral reef related activities.

### III. REDUCE ADVERSE IMPACTS OF FISHING

<b>Project ID#:</b>	20657-2014
<b>Title:</b>	Assessing the Locations and Status of Reef Fish Spawning Aggregations in the Florida Keys
<b>PIs and co-PIs:</b>	Todd Kellison (SEFSC) & Chris Taylor (NOS)
<b>Duration of Project:</b>	Year 3 of 3
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2014**

In FY14, this project continued efforts to identify and assess reported reef fish spawning aggregations (FSAs) in the Florida Keys. Building on prior research in the upper and lower FL Keys, the team focused on multiple sites in the lower, middle and upper Keys to accomplish two objectives: (1) assess whether reported FSA sites are characterized by similar habitat characteristics, with a focus on geomorphological features, and (2) assess fish utilization patterns of reported FSA sites.

#### **Description of accomplishments & results**

In FY14, this project continued efforts to (1) perform field surveys to assess the locations and status of reported reef fish spawning aggregations in the FL Keys, and (2) communicate project results to relevant management agencies.

For the field work component, the research team performed on-water (acoustic and diver) and aerial surveys across multiple months and predicted spawning moons. On-water surveys focused on known or reported aggregation sites in the vicinity of Key West, FL. Surveys were performed during the full-moon periods of May, June, July and August. Gray snapper aggregations were documented at multiple sites during multiple months – providing further evidence of the importance of areas such as Western Dry Rocks and Toppino Reef as spawning-related aggregation sites for gray snapper. Interestingly, despite on-water and aerial surveys during the predicted May and June mutton snapper moons, little activity (including limited fishing pressure) was observed at known aggregations sites Western Dry Rocks and Eyeglass Bar. Fished heavily in recent years, this was the second consecutive year for which mutton aggregations did not appear (based on field observations and reports from fishers and fishery-dependent port samplers) to be occurring at those sites.

Additionally, in anticipation of the next phase of this project (examining multi-species connectivity between aggregation sites), the project's FWC collaborators deployed 32 acoustic receivers in the vicinity of multiple known and reported aggregation sites, and began acoustically tagging focal species (snapper and grouper).

Project results were communicated to FKNMS managers via frequent verbal (including in-person meetings) and e-mail updates during and after the field season, through provision of data and related information to project leaders for the ongoing CRCP-funded Biogeographic Assessment for the FL Keys, and by working closely with, and providing data to, the Ecosystem Protection Working group of the Florida Keys National Marine Sanctuary's review process.

**How project supports goals & objectives of CRCP**

This project primarily addresses Objective F2.4 through the identification of FSAs and their locations with respect to existing no-take MPAs. Results will help managers in the Florida Keys meet their Jurisdictional Objective A1.2 in developing a comprehensive zoning plan in terms of evaluation of the location, size and rezoning of Sanctuary Preservation Areas (i.e., no-take areas).

**How project supports management of coral reef resources**

FSAs are a vital part of the life cycle of many reef fishes. Unfortunately, the act of aggregation makes aggregating species particularly vulnerable to overfishing. The protection and conservation of FSAs is critical to the sustainable management of grouper, snapper, and other reef fish fisheries, from both fisheries and ecosystem perspectives. Results from this ongoing research effort will help to identify aggregation locations and thus facilitate sustainable management for the aggregating species. FKNMS managers are kept abreast of research results (via direct communication from project PIs) and directly support the research through making resources available for use (e.g., vessels and docking facilities).

**List of project partners and their roles**

- NOS-CCFHR – Chris Taylor serves as co-PI on the project
- State of Florida - FWC – cooperative field sampling and data analysis

**Communications, media exposure, capacity building, education and outreach activities**

- Presentation to Florida Keys Community College, Key West, Florida, March 2014
- Presentation at Switlik Elementary School, Marathon, Florida, May 2014

**Submissions to CoRIS**

None

**FY2014 Publications**

None

**FY2014 Presentations**

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. American Fisheries Society Southern Division meeting, Charleston, SC. Jan 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. Florida Keys Community College, Key West, FL. Mar 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. Southeast Acoustic Consortium Biannual Workshop, Panama City, FL. Apr 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. Switlik Elementary School, Marathon, FL. May 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. Semiannual Florida Acoustic Cooperative Telemetry (FACT) group meeting, Jupiter, FL. May 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. iTag workshop, St. Petersburg, FL. May 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. Florida Keys Community College, Key West, FL. Oct 2014.

Morley, D, A Acosta, C Taylor and T Kellison. Reef fish spawning aggregations in the FL Keys. SEAFWA conference, Destin, FL. Oct 2014.

**Setbacks or challenges encountered in FY2014**

None

**Comments on future direction of project**

None



Figure: Gray snapper aggregation at Western Dry Rocks – July 2013 (image credit: Chris Taylor).

<b>Project ID#:</b>	1064 – 2014
<b>Title:</b>	National Coral Reef Monitoring Program
<b>PIs and co-PIs:</b>	PI: Jim Bohnsack (SEFSC); coPIs: Jerry Ault (UM-RSMAS), Steven Smith (UM-RSMAS)
<b>Duration of Project:</b>	Year 1 of 1, ongoing project
<b>Project Category:</b>	National Coral Reef Monitoring Program

#### **Brief description of activities conducted in FY2014**

FY14 was the first year of NCRMP implementation in Florida. SEFSC's project team adapted long-term fish monitoring under the Reef Visual Census Program (RVC) (ongoing since 1979) to meet the intent of the NCRMP fish monitoring goals, and worked with regional partners to implement the benthic components. The domain for the surveys was from the Dry Tortugas to the northernmost portion of the Florida reef tract (Martin County). In Florida, RVC was used as the fish monitoring protocol, and the team adopted the NCRMP-Atlantic standardized benthic protocols consisting of a line-point intercept method (for benthic cover) and a belt transect (for coral demographics). SEFSC's reef fish monitoring team also contributed to NCRMP surveys in Puerto Rico in 2014. Additional activities included NCRMP and RVC training, database and web-based data entry development and maintenance, and the conclusion of a modeling exercise to determine sampling efficiency of the current two stage, stratified random approach used by the RVC program. The project team continues to cultivate and expand the NCRMP/RVC partner base to augment the power of this collaborative program and deliver high caliber monitoring data to a variety of management partners.

#### **Description of accomplishments & results**

2014 was the first year of "NCRMP" monitoring in Florida. NCRMP activities were integrated with the ongoing multi-agency RVC fish monitoring program in Florida. Prior to the summer field season, RVC partners convened a field-methods working group to investigate the feasibility of integrating the benthic NCRMP protocols into the extant fish monitoring program. Both cost (dollars and personnel time) and data quality impacts were assessed. The team completed 144 experimental dives as part of the field experiment. Results suggested that incorporating the Line Point Intercept (LPI) benthic methods into the reef fish surveys would add significant time to each survey thereby reducing the number of sites that could be visited with the same operating budget. Simulation studies demonstrated that by reducing each fish sample from 2 divers to one would drastically alter the variance structure of the resulting data. The results of this experiment scientifically showed that RVC's two stage design, plus within site replication, is a critical design element that drives variance down. Because of these results, the NCRMP and RVC teams agreed to decouple the NCRMP fish and LPI benthic surveys in Florida. To execute NCRMP benthic surveys (both LPI and Demographics), the team contracted Dr. Steven Miller from NSU to lead benthic monitoring throughout Florida (with assistance from SEFSC and NPS divers). The existing RVC teams continued to execute the reef fish monitoring.

Over the course of the field season, 1189 fish sites were completed from Martin County through the Dry Tortugas. 433 sites were completed in the Florida Keys, 436 sites in the Dry Tortugas, and 320 sites from Miami-Dade County to Martin County, also known as the Southeast Florida Coral Reef Initiative (SEFCRI) region (4 dives conducted at each site). 77 divers from 17 different agencies participated and jointly completed ~4750 scientific dives. This level of effort was only achievable thanks to the ongoing

partnerships with the National Park Service, FWC, and Florida's Department of Environmental Protection (FDEP) which had separate funding to implement RVC in the SEFCRI region this year). Two 10-day expeditions to the Dry Tortugas were completed (one funded by NCRMP, one funded by NPS). 60 water samples were collected in the Tortugas on behalf of the NCRMP Climate/Ocean Acidification team. A video of the Tortugas mission can be viewed at: <https://www.facebook.com/photo.php?v=671825412900356>. The benthic team (and partners) completed ~400 combined LPI and Demographic surveys (approximately 128 in the Dry Tortugas, 50 in the SEFCRI area, and 200+ (ongoing) in the Florida Keys. More than half of these surveys were completed using a two stage design. All Florida data have been entered and passed through the assurance/quality control procedures, and is in the final stage of Quality Assurance/Quality Control (QA/QC). FY14 data will be used to generate sampling points for future NCRMP surveys.

Additional activities included updating the sample frame in Florida from a 200mx200m grid cell to a 100mx100m grid cell, by incorporating new benthic habitat information from the regional "unified map". While the 100m grid cell resolution still requires a two stage design, habitat mapping resolution is greatly enhanced. The team also facilitated discussions with TNC's Florida Reef Resilience Program to investigate if their event-based surveys could be integrated with NCRMP benthic data collection.

The team made significant investments in cultivating and expanding partnerships and also, training. In November 2013, the team hosted a Florida fish monitoring partners meeting which included representation from NCRMP plus NPS, FWC, University of Miami (UM), NSU, UM/RSMAS, DEP, and FKNMS to discuss the interplay between RVC and NCRMP. NCRMP leadership also traveled to Puerto Rico in February 2014 to engage partners and take stock of local capacity available to achieve NCRMP goals. The team met with Puerto Rico's Department of Natural and Environmental Resources (DNER), USFWS, the Coast Guard, the University of Puerto Rico, TNC, private contractors, and NMFS. Two meetings were held with NOAA AOML so the climate and biological monitoring teams could meet to share ideas, platforms, and trainings. The team engaged the US Fish and Wildlife diving program at their annual meeting (Crystal River, Florida) to see if they could provide trained divers for NCRMP field missions. The Florida team also conducted two multi-agency partner training workshops in April, 2014 - one at NSU and the other at the NPS Headquarters in Palmetto Bay, Florida.

SEFSC significantly enhanced the efficiency of data entry and QA/QC by developing and launching a new web-based data entry tool that can be used by all Florida partners to input data to a common database. It was piloted on the first Tortugas cruise and was used successfully throughout the 2014 field season. More than 5000 records (both benthic and fish) have now been submitted through the new web-based data entry tool. The SEFSC-developed "site tracker" map was also used to track progress on site completion in both Puerto Rico and Florida this year - providing passive updates on all partner progress and ensuring that sites were not duplicated.

Team members continue to work together on evaluating data quality and variances to determine efficient sample allocation for future years' work. The team is working towards consistent data post-processing techniques and analysis ready formatting of datasets. The team is also working on refining site allocation by updating maps, and implementing new photo and video techniques.

#### **How project supports goals & objectives of CRCP**

Monitoring of coral reef fish and habitat resources is critical to the assessment of ecosystem status and trends, and the effectiveness of management actions, particularly as they relate to MPAs and the effects of fishing on coral reef ecosystems. Data from this effort has directly contributed to CRCP objectives

F1.6 and F2.5. This project is funded by the CRCP's NCRMP and is co-led by the NOS/Biogeography program.

### **How project supports management of coral reef resources**

The SEFSC reef monitoring team provided data and analysis to support many management needs in 2014. NMFS Protected Resources requested ESA coral presence/absence data from all NCRMP missions. SEFSC provided analysis on petitions to list both yellowtail damselfish and Nassau grouper under ESA. SEFSC provided data to the SEDAR stock assessment process for both hogfish and red grouper. SEFSC reef fish data also played a prominent role in the FKNMS management plan review and the update to Biscayne National Park's management plan. The team also participated in a Caribbean Fishery Independent Workshop in September to demonstrate how RVC/NCRMP reef fish data could be used to generate indices for stock assessment purposes. Data and analytical results will also be used to describe status and trends of reef fish and benthos populations in Florida, the US Caribbean, and the Flower Garden Banks National Marine Sanctuary under NCRMP.

### **List of project partners and their roles**

- NMFS-SEFSC – co-lead of the Atlantic biological monitoring components of NCRMP
- NOS-Biogeography Program - co-lead of the Atlantic biological monitoring components of NCRMP
- PR-DNER – Logistical Support
- OAR AOML – NCRMP climate program integration, training
- UM-RSMAS – data management, statistical design, training, fieldwork, analysis, reporting
- NOS-CFFHR – benthic protocol development, training
- NSU – benthic protocol development, fieldwork, training, analysis
- UVI – benthic protocol development, training, fieldwork
- NPS – in-kind boat and fieldwork support, training, analysis
- FKNMS – in-kind boat and diver support
- FWC – in-kind boat and fieldwork support, training, analysis
- TNC – Reef Resilience Program, PR logistics
- USFWS – logistic support in PR
- Coast Guard – logistic support in PR
- UPR – logistic support and fieldwork in PR
- NOAA Restoration Center – fieldwork support in PR
- FDEP – in-kind, logistic and fieldwork support

### **Communications, media exposure, capacity building, education and outreach activities**

- Florida Partners' Meeting, November 2013
- Puerto Rico NCRMP Planning Meetings, February 2014
- Presented NCRMP to USFWS National Dive Program meeting in Crystal River, FL, April 2014
- RVC/NCRMP Florida Trainings (NSU, NPS: Palmetto Bay), April 2014
- SEFSC/AOML collaboration meeting, May 2014
- Florida Coral Reef Manager's Meeting, May 2014
- Fishery Independent Survey Workshop, September 2014

### **Submissions to CoRIS**

Metadata will be submitted following QA/QC



#### **FY2014 Publications**

Ault, J.S., S.G. Smith, J. Browder, W. Nuttle, E.C. Franklin, J. Luo, G.T. DiNardo, and J.A. Bohnsack. 2014. Indicators for assessing the ecological dynamics and sustainability of southern Florida's coral reef and coastal fisheries. *Ecological Indicators* 109: 2541. <http://dx.doi.org/10.1016/j.ecolind.2014.04.013>

Javech, J and J. Blondeau. 2014. Investigator's Annual Report: Reef Fish Visual Census in Biscayne National Park FY2013. Unpublished report. PRBD-2014-04. 2 p.

Smith, S.G., J.S. Ault, J.A. Bohnsack, J. Blondeau, A. Acosta, J. Renchen, M.W. Feeley, and T.A. Ziegler. 2014. Fisheries-independent data for hogfish (*Lachnolaimus maximus*) from reef-fish visual surveys in the Florida Keys and Dry Tortugas, 1994-2012. FWC SEDAR Data Working Paper. Protected Resources and Biodiversity Division unpublished document PRBD-2014-02.

Southeast Fisheries Science Center. 2014. Population trends for Yellowtail damselfish (*Microspathodon chrysurus*) from forereef, high relief spur and groove coral reef habitats in the Florida Keys 1980-2012. Report to NMFS Southeast Regional Office. PRBD-2014-03. 5 p.

#### **FY2014 Presentations**

Bryan, D. Southern Florida Reef Fish Visual Survey. September, 2014. MARFIN Caribbean Fishery Independent Data Workshop. Miami, Florida.

Bryan, D. Transport and connectivity modeling of larval permit from an observed spawning aggregation in the Dry Tortugas, FL. November 2014. Fifth International Bonefish and Tarpon Trust Symposium. Dania Beach, Florida.

Clark, R. National Coral Reef Monitoring Program (NCRMP). September, 2014. MARFIN Caribbean Fishery Independent Data Workshop. Miami, Florida.

Jeffrey, C. National Coral Reef Monitoring Program (NCRMP). November, 2014. Gulf and Caribbean Fisheries Institute Annual Meeting. Bridgetown, Barbados.

Schull, J. The Coral Reef Conservation Program's National Coral Reef Monitoring Plan. May 2014. AOML/SEFSC Science Meeting. Miami, Florida.

Schull, J. NOAA NCRMP - The Coral Reef Conservation Program's National Coral Reef Monitoring Plan. April 2014. USFWS Annual Diver Training and Recertification Meeting. Crystal River, FL.

#### **Setbacks or challenges encountered in FY2014**

In some cases, anticipated partnerships in Puerto Rico (pledged boat and personnel support) did not materialize so the NCRMP team will continue working to cultivate those relationships. Benthic monitoring in the SEFCRI region proved challenging because of capacity in that region and strong currents.

### Comments on future direction of project

2016 will be the next year for Florida NCRMP monitoring. The project team will work with Florida partners to distribute and analyze full data sets from the 2014 monitoring surveys to help optimize future sampling. The project team will also work with Florida DEP to develop a strategy for integrating SEFCRI into the NCRMP monitoring framework.

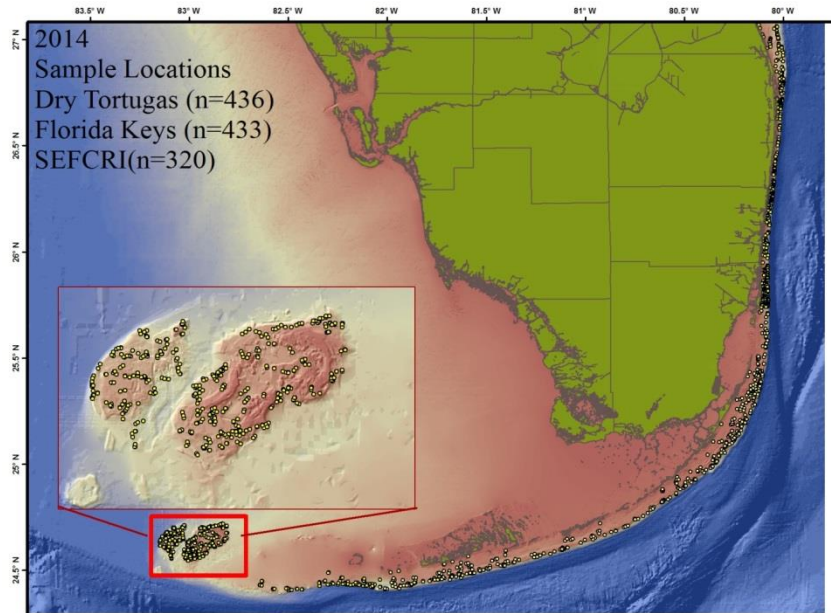


Figure: Fish survey locations along the Florida Keys reef tract (north to Martin County) during FY14, including the Dry Tortugas region. Four data collection dives occurred at each site.

<b>Project ID#:</b>	0831-2014
<b>Title:</b>	A Creel Survey of the Recreational (Non-Commercial), Boat-Ramp-Based Fisheries in St. Croix
<b>PIs and co-PIs:</b>	Jim Berkson (SEFSC)
<b>Duration of Project:</b>	Year 2 of 3
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2014**

FY14 was the second year of funding for this project, but unforeseen challenges in identifying and transferring funding to an appropriate partner has delayed implementation of activities. Progress has been made on survey design, paperwork reduction act submissions, and development of partnerships, and is still ongoing. Theresa Goedeke, with NOS SCCOS continues to be a valued advisor on this project along with the SEFSC's social science research group. It is anticipated the active phase of the project will begin in 2015.

#### **Description of accomplishments & results**

The primary accomplishment was the transfer of project operational funds (years one and two of the project) to CIMAS and development of a CIMAS work plan.

#### **How project supports goals & objectives of CRCP**

One of the key goals of the CRCP is to increase the abundance and average size of key coral reef fishery species. To do this, basic information on major fisheries as well as population dynamics of the species must be collected, which directly contributes to CRCP's Objective F1.4. The non-commercial, boat-ramp-based fisheries in St. Croix are assumed to be significant fisheries on the island, but data are not currently available. This project would begin to provide those data.

#### **How project supports management of coral reef resources**

Without information on catch, there may be overexploitation of critical stocks, impacts on multiple trophic levels, bycatch of non-target species; and reefs may be impacted due to fishing methods. The project will answer two important research questions: (1) What is the best way to collect essential data for these fisheries? And (2) What are the current levels of catch and effort in these fisheries?

#### **List of project partners and their roles**

- SEFSC Sustainable Fisheries Division - review of data collection protocol, storage methods, and analytical tools.
- SEFSC Social Science Research Group - review the socio-economic aspects of the study to ensure best practices.
- SERO Habitat Conservation Division - provide on-the-ground assistance on St. Croix.
- SERO Sustainable Fisheries Division - work with the project team to develop strong relationships with the regional management agencies.
- NOS Center for Operational Oceanographic Products and Services – advise the project team drawing from their experience working on a complementary shore-based survey
- NOS Office of Ocean and Coastal Resource Management – advise the project team on St. Croix fishers and fisheries.
- University of Miami, CIMAS - help design, implement, manage, analyze and write-up the study.

- The Caribbean Fisheries Management Council - ensure that the project is filling a critical data gap need to better manage fisheries in the US Virgin Islands (USVI).
- The USVI Department of Planning and Natural Resources (DPNR)- Division of Coastal Zone Management - provide information about the spatial distribution of reef habitat that can be compared with the distribution of fishing effort estimated by the creel survey.
- The USVI DPNR Division of Fish and Wildlife - provide feedback on project design and execution to ensure that the project meets its needs. It will also provide expertise on the fish, fishers, and fisheries of St. Croix.

**Communications, media exposure, capacity building, education and outreach activities**

None

**Submissions to CoRIS**

None

**FY2014 Publications**

None

**FY2014 Presentations**

None

**Setbacks or challenges encountered in FY2014**

Since project inception, there have been unforeseen barriers and delays identifying and implementing an avenue to pass funds from NOAA to the implementing partners. The University of Florida rejected the NOAA funding to support this project and the project team entered into agreement with Dr. David Die at the Cooperative Institute of Marine and Atmospheric Studies (CIMAS) at the University of Miami, RSMAS. Since funding can only be transferred to CIMAS one time per year, the project was stalled yet again. Now that funds are at CIMAS, the active phase of the project should be initiated soon.

**Comments on future direction of project**

None

<b>Project ID#:</b>	1100-2014
<b>Title:</b>	Assessing Performance and Connectivity of St. Croix MPAs
<b>PIs and co-PIs:</b>	Jennifer Doerr & Ron Hill (SEFSC)
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2014**

Research activities this year were conducted during field expeditions to St. Croix, U.S. Virgin Islands, in August 2014. Along with project partners, the National Park Service (NPS), juvenile and adult queen conch were tagged with numbered identification tags and acoustic transmitters inside Buck Island Reef National Monument (BIRNM). Radial surveys were conducted and the benthic composition was described at each tagging site. The NPS downloaded the first set of acoustic data from the hydrophone array in October 2014, and these data are currently being analyzed.

#### **Description of accomplishments & results**

During field work this year, 26 queen conch (10 juveniles and 16 adults) were tagged at 12 sites along a depth (from 3 – 20 m) and habitat gradient within BIRNM. Tagging operations were conducted near the peak of the reproductive season when adult conch are likely migrating to spawning areas. At each tagging site a 10-m radial survey was completed, and during these surveys the project team located and measured a total of 234 conch (133 juveniles and 101 adults) in sand, seagrass, and colonized pavement/hardbottom habitats. Densities calculated from radial survey data could be considered high, from a regional perspective, with a total density of 620.7 conch per hectare, with the highest habitat-specific density in seagrass (1591.6 conch per hectare). Short-term tracking information from the two months of acoustic data obtained thus far show adults moving more than juvenile conch. Several adult conch were tracked moving south from Buck Island toward the mainland of St. Croix, and potentially across the reserve boundary into open fishing areas, and connecting with the inshore areas of the St. Croix East End Marine Park (EEMP).

#### **How project supports goals & objectives of CRCP**

The queen conch is an important cultural component and an extremely valuable coral reef fishery resource throughout the Caribbean, historically second in value only to the spiny lobster. Habitat degradation and overfishing have led to significant declines in population numbers from historic levels. Populations of queen conch have been slow to recover in spite of management measures including complete fishery closures, shortened harvest seasons, and size restrictions. Marine protected areas can increase the abundance of exploited marine species, but the effectiveness of a reserve area for a slow-moving benthic species like queen conch depends heavily on matching the spatial aspects such as area, configuration, and location of MPA boundaries to the ecological needs of the species. SEFSC's biological research and monitoring supports CRCP 's Objective F2.5 by assessing the performance of the BIRNM marine reserve and the connectivity within the local network of reserve areas. This work also contributes to Objective F1.3 by collecting data on movements and habitat preferences of queen conch which provides a basis for protecting and restoring conch populations near St. Croix.

### **How project supports management of coral reef resources**

Queen conch were once abundant in coral reef ecosystems, but declines in population numbers are consistently reported throughout their range. Within the US Caribbean, queen conch are currently managed with daily catch quotas, annual total catch limits, seasonal closures coinciding with the main reproductive period (June 1 – November 1), and spatial closures or marine reserves. Reserves are managed by both local jurisdictions (e.g., EEMP) and federal agencies (e.g., BIRNM), and vary in their fishing regulations from full closures to managed areas. To maximize management effectiveness, both seasonal and spatial closures need to match characteristics of the species' life history patterns. This project is documenting spatial distributions, habitat use, and migration patterns of juvenile and adult queen conch in relation to existing MPA boundaries and identifying critical spawning areas. Data obtained from the acoustic tracking component will provide information on resource connectivity by determining if and when conch move between management zones, most importantly into the open fishing areas between no-take zones, and the timing and duration of these movement patterns. If it is discovered that there is some aspect of conch movement around BIRNM making them more vulnerable to capture during critical times, recommendations for management modifications will be drafted and submitted to the appropriate managers.

### **List of project partners and their roles**

- NPS – The St. Croix NPS office oversees and coordinates activities with all collaborators on the larger acoustic tagging and tracking project. Agency personnel are contributing input on the experimental design, installing hydrophone receivers, downloading and maintaining receivers, disseminating data to research groups, and providing vessel and personnel use during field trips.
- NOS/Biogeography Branch – Contribute acoustic receivers to the project and are tagging reef fish in the study area.
- U.S. Geological Survey – Contribute acoustic receivers to the project and are tagging sea turtles in the study area.
- Massachusetts Division of Fish and Wildlife – Contribute acoustic receivers to the project and are tagging sharks in the study area.

### **Communications, media exposure, capacity building, education and outreach activities**

The project team collaborated with the NPS to develop a flyer that was posted in local dive shops, businesses, and the NPS visitor center. The flyer contains information about queen conch, the goals of the research, photos of the tags, and instructions for reporting the discovery of a tagged shell in the area.

### **Submissions to CoRIS**

None

### **FY2014 Publications**

None

### **FY2014 Presentations**

None

### **Setbacks or challenges encountered in FY2014**

Due to obstacles encountered during the permitting process, the NPS was unable to install additional hydrophones in the open fishing areas and EEMP south of BIRNM. Since the array was not complete as

originally planned and a primary project objective is to determine movement patterns of conch between management zones, the tagging range was limited to queen conch closer to Buck Island in FY14. Although this was an unanticipated setback, the team will still be able to gather valuable information on the movement patterns of conch around Buck Island, including site fidelity measures, habitat-specific residence times, and localized movements.

#### **Comments on future direction of project**

Tagging and radial surveys of queen conch will continue in the study area through FY15 and FY16. Field sampling in FY15 will expand to include range testing to further define detection zones of acoustic hydrophones throughout the array, supplementing detection information collected by the project's USGS partners. The team will also attempt to relocate previously tagged conch via manually operated directional receivers to confirm their locations within the array. Efforts to expand the existing hydrophone array south of BIRNM in the open fishing zones and into the EEMP will continue. If successful, the project partners will work together to determine placement of additional receivers.

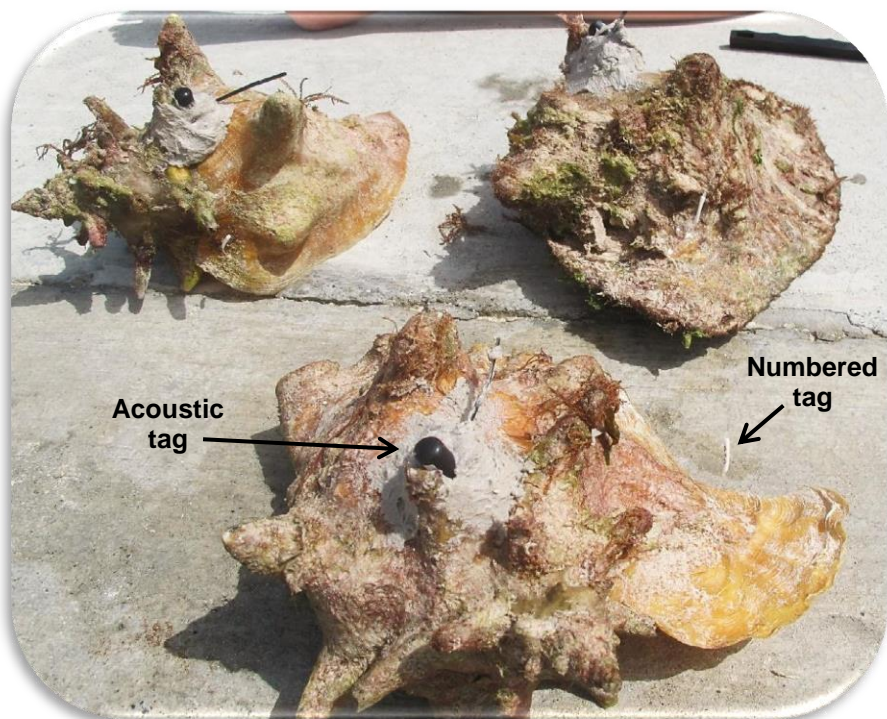


Figure: Juvenile and adult queen conch showing the placement of numbered identification and acoustic tags (photo credit: Katie Flynn, NOAA Volunteer).



<b>Project ID#:</b>	182-2014 UPDATE
<b>Title:</b>	The Importance of Parrotfish (fam. Scaridae) on the Maintenance and Recovery of Coral-dominated Reefs
<b>PIs and co-PIs:</b>	Margaret Miller (SEFSC), Benjamin Ruttenberg (SEFSC), & Tom Adam (FIU-CIMAS)
<b>Duration of Project:</b>	Funded 2011-2012
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2014**

This project was funded in FY11 and FY12, but work for this project continued into FY13 and FY14. In FY14 the PIs finished a comprehensive synthesis of the current state of knowledge regarding interactions between herbivores, algae, and corals on Caribbean coral reefs. The team also processed and analyzed field data on the diet and foraging behavior of parrotfishes, and initiated some additional targeted field work to address outstanding knowledge gaps. Results from the synthesis and fieldwork were communicated with scientists and managers via formal presentations and informal communications at scientific meetings and working groups and through a One NOAA Science webinar.

#### **Description of accomplishments & results**

The synthesis was accepted as a Review Article in Marine Ecology Progress Series and will be highlighted as the Feature Article in the February 2015 issue. The PIs also submitted a manuscript documenting diet and foraging behavior of Caribbean parrotfishes for publication in a peer-reviewed ecological journal (Ecological Applications). These data are the results of field work conducted during 2012 and 2013 which fill critical knowledge gaps needed to predict the impacts of different species of parrotfishes on coral reef ecosystems. The results of the synthesis and field work were presented at several scientific meetings, webinars, and national and international working groups on coral reef resilience and reef restoration. The PIs also submitted a metadata record for the field work which has been published by CoRIS. CoRIS also developed a web page to highlight this project (see below).

#### **How project supports goals & objectives of CRCP**

CRCP aims to minimize the negative impacts of fishing on coral reef ecosystems by focusing management effort on species or functional groups which are essential for ecosystem function. While a large body of literature identifies parrotfish (and herbivores in general) as one such functional group, better information is needed about how effectively different species graze algae, and what these effects are on coral settlement, survivorship, and growth under a range of environmental conditions. To address these needs, this project synthesized the best scientific information available on the relationships between herbivores, coral, and algae, and identified and addressed key knowledge gaps that contribute to CRCP's Objective F1.3, and are currently limiting the ability to predict how management actions targeting different species of parrotfishes will impact reef ecosystems.

#### **How project supports management of coral reef resources**

Herbivorous fishes (and especially parrotfishes) are a large component of many coral reef fish fisheries including those in the U.S. Caribbean, as well as important components of coral reef ecosystems. The synthesis and fieldwork conducted by the PIs has helped identify which combinations of parrotfishes are likely to be most effective at controlling algae and facilitating coral growth and recruitment. This information has been communicated with coral reef managers through formal and informal communications and presentations. Upon publication, copies of manuscripts currently in press and



under review will be provided to points of contact at NOAA SERO, NOAA SEFSC, South Atlantic Fishery Management Council (SAFMC), Gulf of Mexico Fishery Management Council (GMFMC), CFMC, FKNMS Advisory Council, FL FWC, and the U.S. Coral Reef Task Force. The PIs are also finishing a succinct report aimed at communicating the key results from the synthesis and field work to coral reef managers. This report will be provided to points of contact at the same agencies to ensure the information is used to inform fisheries, ecosystem, and protected species management throughout the U.S. Caribbean.

#### **List of project partners and their roles**

- FIU - Deron Burkepile: academic leader
- FIU/CIMAS - Thomas Adam: post-doctoral associate
- Santa Barbara City College - Michelle Paddack: associated investigator/contributor

#### **Communications, media exposure, capacity building, education and outreach activities**

- Active collaboration with the Marine Resource Development Foundation, Key Largo, FL.
- OneNOAA Science Seminar, September 2014
- Seminar at UM/RSMAS, July 2014

#### **Submissions to CoRIS**

Metadata record for field work on parrotfish

CoRIS Project Portal: [http://www.coris.noaa.gov/activities/herbivores\\_caribbean/](http://www.coris.noaa.gov/activities/herbivores_caribbean/)

#### **FY2014 Publications**

Adam, T. C., Burkepile D. E., Ruttenberg B. I., Paddack M. J. (In press) Herbivory and the resilience of Caribbean coral reefs: knowledge gaps and implications for management. *Marine Ecology Progress Series*. doi:10.3354/meps11170

Adam, T. C., Kelley M., Ruttenberg B. I., Burkepile, D. E. (In review) Resource partitioning along multiple niche axes drives functional diversity in Caribbean parrotfishes. *Ecological Applications*

Adam, T. C., Burkepile D. E., Ruttenberg B. I., Paddack M. J. (in review) Managing herbivores for their impacts on Caribbean coral reef ecosystems: A summary report for managers and practitioners. PRBD Report. US National Marine Fisheries Service

#### **FY2014 Presentations**

Adam, T. C., Burkepile, D. E., Ruttenberg, B.I. Phylogenetic history drives niche complementarity in Caribbean parrotfishes. Western Society of Naturalists Annual Meeting, Oxnard, CA, November 2013.

Adam, T. C. Herbivory, diversity, and the resilience of coral reef ecosystems: beyond functional groups. Groupment De Recherche International working group on coral reef resilience, Aquarium de la porte doree, Paris, France, December 2013 .

Adam, T. C. Herbivory and the resilience of Caribbean coral reefs. Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, FL, July 2014.

Adam, T. C. Herbivory and the resilience of Caribbean coral reefs. OneNOAA Science Webinar, September 2014 .

Adam, T. C. The process of herbivory and coral reef restoration. Florida Fish and Wildlife Conservation Commission Coral Restoration Workshop, NOAA Southeast Fisheries Science Center, Miami, FL, September 2014.

Ruttenberg, B. I. Fear, loathing and monitoring in the Caribbean: the challenges of maintaining optimism in an ecosystem in decline. Marine Science Seminar Series, Moss Landing Marine Labs, Moss Landing, CA, April 2014

Ruttenberg, B. I. Fear, loathing and monitoring in the Caribbean: the challenges of maintaining optimism in an ecosystem in decline. Central Coast Biological Society Quarterly Meeting, San Luis Obispo, CA, October 2014.

**Setbacks or challenges encountered in FY2014**

None

**Comments on future direction of project**

The PIs have sought and secured additional funding from the CRCP to quantify the impacts of different species of parrotfishes on benthic communities around St. Croix, USVI and predict the ecosystem level impacts of different fisheries management strategies.



Figure: A midnight parrotfish grazing on algae in the Florida Keys. Photo Credit: Alain Duran.

<b>Project ID#:</b>	878-2014
<b>Title:</b>	Defining Spawning Dynamics to Manage and Conserve Reef Fish Populations
<b>PIs and co-PIs:</b>	Ron Hill (SEFSC)
<b>Duration of Project:</b>	Year 1 of 3 (funding committed for Years 1 and 2)
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2014**

Our primary research approach uses hydrophone receivers to record the sounds groupers make during courtship and spawning, documenting the locations and times of grouper spawning aggregations. In FY14, twelve digital spectrogram (DSG) long-term acoustic recorders were deployed (12/2013) at six sites off western Puerto Rico prior to the spawning season. Throughout the spawning season, divers, using video and laser calipers, repeatedly surveyed the sites to record the size structure and density of groupers, including red hind, Nassau, yellowfin, tiger, and black grouper. The DSGs were retrieved between May and August 2014 and data were downloaded, processed, verified, and archived. Numbers of species-specific grouper calls have been analyzed to quantify the number of calls per species for the entire season. The times and locations of calls help to define the precise spawning locations and the temporal pattern of the aggregation.

#### **Description of accomplishments & results**

During this year, we completed deployment and collection of DSGs with their recorded grouper courtship and spawning sounds at Abrir la Sierra, Tourmaline, Bajo de Sico, Mona Island, and Monito. More than 256 gigabytes (GB) of sound data were collected. Five different grouper species have been verified by their unique calls. In the future, recordings of these species-specific calls will be indicators of when and where different grouper species are using aggregation sites, even without diver confirmations. This will help to ensure better continuous monitoring.

Divers conducted surveys at each of the monitored sites, recording species, size structure, and density. These data provide a better understanding of the distribution of different species of spawning groupers, as well as a standard against which to compare the DSG sound files. Some of the dives were conducted with closed circuit rebreathers by our partners at University of Puerto Rico-Mayagüez (UPR-M) because of depths at which the groupers aggregate (100 - 170 ft).

In preparation for expanding monitoring efforts into the NE Reserves of Puerto Rico, mapping and compilation of available data has begun, and additional information is being gathered from area fishers and divers. This effort will continue in FY15/16.

Data from project findings have been presented to the Caribbean Fisheries Management Council's Science and Statistics Committee (CFMC SSC) by our research partners and have been the basis for discussions of best management measures to protect these spawning aggregations.

#### **How project supports goals & objectives of CRCP**

Reef fish spawning aggregation sites need additional management and conservation as evidenced by localized depletion of large predators such as groupers. Two of the largest of the Atlantic groupers, Nassau and goliath, have been depleted throughout their range because of fishing pressure and habitat

loss. Puerto Rico has worked to provide some spatial and temporal protection but, to date, there is little evidence these species are recovering. This project is characterizing spawning sites of aggregating groupers and other species within designated MPAs, transferring technology from priority areas on the west coast of PR to priority areas undergoing management planning in the NE Reserves of Puerto Rico. We are directly addressing CRCP Objective F1.6, by *conducting applied biological research and monitoring to evaluate effectiveness of spatial and seasonal coral reef ecosystem management actions on key species or groups*, as well as, supporting Fishing Impacts Goal 2 which calls for *effective implementation and management of marine protected areas (MPAs)*. In accordance with Objective F2.4 we are working *with relevant agencies, offices, and communities to implement, and improve the management of MPAs that protect key coral reef ecosystem components and functions*. Research applying these complementary, innovative, techniques will provide data needed to fill gaps (improve management) in MPA assessments for Cabo Rojo and NE Reserves.

### **How project supports management of coral reef resources**

The fisheries of the US Caribbean are considered data-poor by stock assessment scientists and fisheries managers, including the CFMC and PR DNER. Fishery dependent data, relying on fisheries landing, are inadequate for proper understanding of population status of most reef fish and fisheries. Fishery-independent studies using research methods are a critical addendum in these cases. Our spawning aggregation studies contribute data and analytical results on the status of spawning stocks (populations) that will improve management effectiveness. Earlier results from the supporting studies have already factored into changes in seasonal (closed season for sales of groupers) and spatial fishery regulations (MPA boundary changes) within PR waters and development of similar or compatible regulations in US waters. Extended findings from this project will refine spatial and temporal understanding of spawning areas on the west coast and will start to bring these technological innovations to the MPAs off NE PR. These contributions will help meet management needs for PR DNER and the CFMC and those mandated under the Magnuson-Stevens Act. All information will support the on-going CRCP work to generate management plans for the NE Reserves and surrounding areas.

### **List of project partners and their roles**

- University of Puerto Rico-Mayagüez (UPR-M)/Caribbean Coral Reef Institute (CCRI) (R. Appeldoorn/ M. Schärer – UPR-M/CCRI has been actively researching into the locations and viability of reef fish spawning aggregations using active and passive acoustics, diver searches and video, and fisher interviews, and successfully located the current western PR study sites. UPR-M/CCRI contributes boat access and manpower (students & scientific divers) and utilizes both open circuit SCUBA and closed circuit rebreathers for deep sites. The current survey methodology was developed collaboratively with UPR-M/CCRI.
- Caribbean Fishery Management Council - Funded a 2-year project to study the distribution and abundance of Nassau grouper at spawning sites including acoustic tagging. Work is undertaken cooperatively with our research efforts, sharing boat access and manpower when advantageous.
- University of the Virgin Islands (UVI) (R. Nemeth)– Experience researching the dynamics of red hind, yellowfin and Nassau grouper spawning aggregations in the USVI and many techniques and approaches have been shared between the two projects. Collaborative research proposals have been submitted to expand the cooperation between UPR-M and UVI partners.
- SEAMAP-C – SEAMAP – C has undertaken a pilot study to investigate the use of passive acoustic monitoring to augment monitoring of red hind populations. Their DSGs are being managed by UPR-M and UVI and data are being downloaded and analyzed by UPR-M partners. Future plans include technology transfer to build data analysis capabilities.

- NMFS SERO (Habitat, Protected Resources, and Sustainable Fisheries Divisions) – Project outcome clients, collaborators and supporters due to its relevance to both fisheries and protected species (Nassau grouper, goliath grouper) implications.
- SEFSC Sustainable Fisheries – Project outcome clients and supporters
- USVI DPNR & PR DNER – Project outcome clients, collaborators and supporters.

### **Communications, media exposure, capacity building, education and outreach activities**

The collaborating researchers have lines of communication with Federal (CFMC, SERO (PR, HC, SF) and jurisdictional (PR DNER Fisheries and 'Reserves' Divs.) managers, as well as with collaborating scientists (e.g., UVI, NMFS SEFSC/Sustainable Fisheries, NOS) and PR Sea Grant. Our plans will be to continue to report interim and final results to local and federal managers and stakeholders through mechanisms such as CFMC meetings (i.e., Council meetings and Science and Statistical Committee meetings). The techniques we have proposed have also been embraced by PR and USVI fisheries departments for SEAMAP-C surveys and we will be in close communication as we train departmental folks and assist with their data interpretation. I have been in communication with Antares Ramos (PR Liaison) who is writing the management plan for the NE Reserves and will provide her all information on fishery use and spawning sites as soon as it becomes available. Collaborators (Schärer and Appeldoorn) are working on joint projects with grouper researchers from UVI and information will be shared across projects to inform future directions and data analysis. All information will be presented publicly in regional (e.g., GCFL, AMLC) and national/international (e.g., AFS, ICRS) scientific meetings and research findings will be submitted for publication in scientific journals. Data and reports will be provided to CoRIS upon completion.

### **Submissions to CoRIS**

An annual report summarizing the year's activities and progress to date was provided to CoRIS: Schärer, Michelle and Ron Hill. Passive Acoustic Monitoring of Fish Spawning Aggregations in Puerto Rico, Progress Report, September 2014.

### **FY2014 Publications**

Schärer, M.T., M.I. Nemeth, T.J. Rowell, and R.S. Appeldoorn. 2014. Sounds associated with the reproductive behavior of the black grouper (*Mycteroperca bonaci*). *Marine Biology* **161**: 141-147.

Schärer, M.T., R. Nemeth, E. Tuohy, K. Clouse, M. Nemeth, and R. Appeldoorn. 2014. Nassau grouper *Epinephelus striatus* Fish Spawning Aggregations in the US Caribbean. *Proceedings of the Gulf and Caribbean Fisheries Institute* **66**: 408-412.

### **FY2014 Presentations**

Appeldoorn, Richard, T. Rowell, M. Schärer-Umpierre, and M. Nemeth. 2013. Corroborating fishermen's knowledge of red hind spawning aggregation sites using passive acoustic mapping techniques. Oral presentation. Gulf and Caribbean Fisheries Institute, Corpus Christi, TX, November 2013.

Schärer, M.T., R. Nemeth, E. Tuohy, K. Clouse, M. Nemeth, and R. Appeldoorn. 2014. Nassau grouper *Epinephelus striatus* Fish Spawning Aggregations in the US Caribbean. Oral presentation. Gulf and Caribbean Fisheries Institute, Corpus Christi, TX, November 2013.

Schärer-Umpierre, M.T., T. Rowell, M. Nemeth, R. Appeldoorn. 2013. Management Applications of Black grouper (*Mycteroperca bonaci*) Sounds at Spawning Aggregations. Poster presentation. Gulf and Caribbean Fisheries Institute, Corpus Christi, TX, November 2013.

#### **Setbacks or challenges encountered in FY2014**

None

#### **Comments on future direction of project**

The project was designed to continue to support the development of innovative techniques to assess and monitor grouper spawning aggregations off the west coast of Puerto Rico and initiate similar efforts off the northeast coast, to enhance management capabilities and advance knowledge in the newly established NE Reserves. Continued support of these efforts should have benefits both in the development of local management support but also in the sharing of effective techniques, as evidenced by the cooperation with the SEAMAP-C program. Year 2 should continue similar efforts, including accelerated planning for NE work and Year 3 will initiate assessment and monitoring in the NE Ecological Corridor and around Culebra.



Figure (Left): Video and laser caliper method at left (photo by M. Schärer)

Figure (Right): Lights from (red) laser calipers, set at 20 cm width, on Nassau grouper, *Epinephelus striatus*, at right (photo by H. J. Ruiz).

#### IV. PROTECTED CORALS

<b>Project ID#:</b>	1091-2014
<b>Title:</b>	Evaluation of ESA Listed <i>Acropora</i> spp. Status and Recovery Actions
<b>PIs and co-PIs:</b>	Margaret W Miller (SEFSC) & Dana E Williams (UM-CIMAS)
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Other, Protected Corals

##### **Brief description of activities conducted in FY2014**

Florida *Acropora palmata* demographic study plots were surveyed for the 11<sup>th</sup> consecutive year and Curacao *A. palmata* study plots for the 9<sup>th</sup> year. Additional upper Keys sites previously mapped (n=5) for presence/absence were re-visited and the locations of all *A. palmata* and *A. cervicornis* were mapped using GPS. The project team formulated an experimental outplanting strategy in collaboration with the Coral Reef Foundation (with input/review from FWC and SERO) designed to address information gaps. The first experiment in this outplanting strategy was implemented, specifically an experiment designed to compare the success of two fragment sizes. A mass coral bleaching event occurred in Florida during September 2014 and additional surveys and sampling were undertaken in response to quantify the progression and impact of this event.

##### **Description of accomplishments & results**

In 2014 the 24 existing *A. palmata* study plots were resurveyed in Jan, May, and Sept. Additionally the team surveyed a more remote site that is only surveyed annually. *A. palmata* populations in the Florida Keys experienced a mass bleaching event in September 2014. In order to capture the timing and impacts of this event the project team conducted additional surveys. Most sites were severely affected by the bleaching event. Although some colonies survived and recovered their normal color, some sites suffered catastrophic mortality.

For the first phase of the outplant experiment, 250 fragments from the CRF nursery were outplanted to 3 different sites to compare the survivorship and growth of two size classes of fragments. The project team intended to resurvey to assess size every 8 weeks but surveyed more frequently to assess condition of the fragments due to the bleaching event. Mortality was widespread among the outplanted fragments, as it was in the wild population, however it was not related to the initial size of the fragment.

Five sites were surveyed by snorkelers with GPS to map the presence or absence of *Acropora* spp. These data have not yet been analyzed because they were completed in July and August, just prior to the bleaching event. Re-surveying these sites next summer may provide a large-scale view of the impact of the bleaching event in addition to the longer term changes that were intended to be captured.

##### **How project supports goals & objectives of CRCP**

This project addresses the CRCP commitment to support the science and recovery of ESA listed coral species. Specifically, this project provides ongoing population monitoring and also evaluation of proposed recovery actions to conserve/expand *Acropora* spp. tissue. In addition, the local Florida jurisdiction has articulated several priorities that are addressed by the current proposal. Specifically Florida identified *Acropora* monitoring as one of its top 5 mapping and monitoring needs to support

management as stated in the Coral Reef Ecosystem Integrated Observing system (CREIOS) Workshop Report. Similarly, endangered species recovery and reef restoration both appear as Florida management priorities and the outplanting field experiments address these priorities. These FL priorities articulated in the CREIOS report are backed up in the Florida Reef Management Priorities document which calls for implementation of the CREIOS Workshop outcomes.

### **How project supports management of coral reef resources**

F2.1: 5 of the project's 7 Florida demographic monitoring sites are in no-take reserves. *Acropora palmata* provides habitat for economically important fisheries species and structural protection for coastal habitats as a 'key taxa' in reef crest environments. Demographic monitoring provides means to assess stability or increase in *A. palmata* abundance in these areas. F2.3: Proposed experiments will restore *Acropora* live tissue and will help refine *A. palmata* outplanting as a management tool to yield additional tissue. C4.1: Developing intervention strategies to preserve coral/increase resilience in priority areas. Any augmentation of live coral, particularly threatened ones, increases population resilience.

### **List of project partners and their roles**

- SERO-Protected Resources - provides co-funding for monitoring of listed spp.
- Coral Restoration Foundation - collaborator on the outplant experiments by providing and outplanting *A. palmata* fragments from their nursery according to the agreed design.

### **Communications, media exposure, capacity building, education and outreach activities**

- Co-hosted a Coral Reef Restoration Science Strategy for the State of Florida with FWC, October 2014
- Participated in the Florida Coral Reef Managers Meeting, May 2014
- Project results were included in an invited presentation to the NMFS Science Board, Feb 2014

### **Submissions to CoRIS**

See publications below

### **FY2014 Publications**

Williams DE, Miller MW, Bright AJ, Cameron CM (2014) Removal of corallivorous snails as a proactive conservation tool. PeerJ 2:e680. <http://dx.doi.org/10.7717/peerj.680>.

Williams DE, Miller MW, Baums IB (2014) Cryptic changes in the genetic structure of a highly clonal coral population and the relationship with ecological performance. Coral Reefs 33:595-606

Bright AJ, Williams DE, Kramer KL, Miller MW (2013) Recovery of *Acropora palmata* in Curaçao: a comparison with the Florida Keys. Bull Mar Sci 89:747-757

Williams DE, Bright AJ (2013) White rings on the threatened coral, *Acropora palmata*, associated with foraging activity of the honeycomb cowfish, *Acanthostracion polygonius* (Ostraciidae). Coral Reefs 32:651

Miller MW, Lohr KE, Cameron CM, Williams DE, Peters EC (2014) Disease dynamics and potential mitigation among restored and wild staghorn coral, *Acropora cervicornis*. PeerJ 2:e541. DOI 10.7717/peerj.541



**FY2014 Presentations**

Miller, Williams, & Baums, “Genetic versus ecological ‘performance’ in a highly clonal, endangered coral” Presentation at Marine Benthic Ecology Meetings, 23 March 2014, Jacksonville FL

Results were included in an invited presentation to the NMFS Science Board, Miami, FL 27 Feb 2014

**Setbacks or challenges encountered in FY2014**

The mass bleaching event observed in the Florida Keys this fall required additional surveys and required more effort, time and resources than originally allocated under this project. This reprogramming of effort, along with extreme stress experienced in local coral nurseries, dictated the delay of planned efforts toward the mapping component and the second planned outplanting experiment. The results of the first outplant (size experiment) may also be less robust due to higher mortality associated with the severe thermal bleaching and disease. However, the research team is well poised to document and describe the arc of this intense bleaching event.

**Comments on future direction of project**

The long-term monitoring will continue as it is one of the longest continuous *A. palmata* monitoring efforts in existence. It provides insights on status/recovery of this listed species in the upper Florida Keys and comparison populations in Curacao. The mapping component will resume in the summer of FY15 when conditions will be more conducive to these surveys. The fragments outplanted in 2014 will continue to be monitored at 4mo intervals. The second outplanting component is a much larger effort and is planned for Spring 2015.

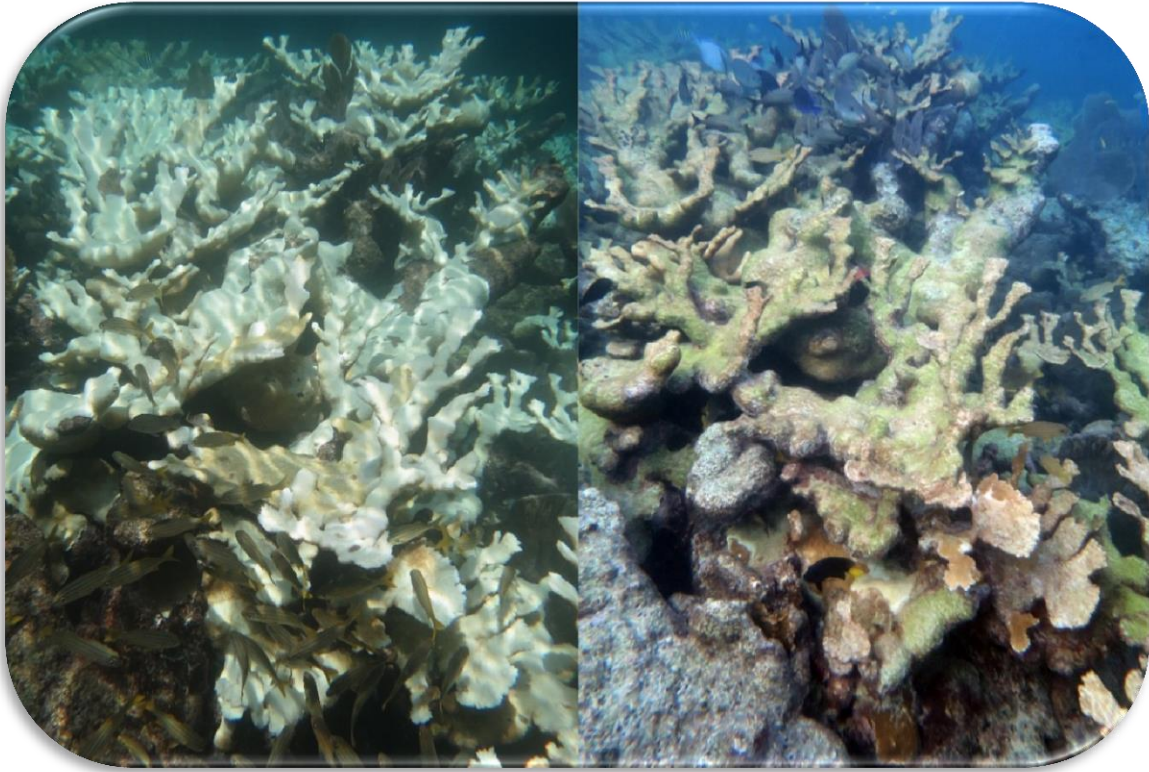


Figure: Patch of *Acropora palmata* at Grecian Rocks as seen in Sept 2014 (left) and 1 month later (right photo taken at the same spot). Extensive bleaching of *A. palmata* occurred in September (bright white tissue predominant in left panel). Although bleached colonies often survive and recover their normal color, this patch suffered catastrophic mortality as shown in this view of the same portion of the *A. palmata* patch with incipient algal turfs (greenish/brownish) colonizing the recently dead *A. palmata* skeleton (Photo Credit: Dana Williams, UM-CIMAS).

<b>Project ID#:</b>	797-2014
<b>Title:</b>	Gamete/Larval Fitness of ESA Listed and Candidate Corals
<b>PIs and co-PIs:</b>	Margaret Miller (SEFSC) and Cheryl Woodley (NCCOS)
<b>Duration of Project:</b>	Year 2 of 3
<b>Project Category:</b>	Other, Protected Corals

#### **Brief description of activities conducted in FY2014**

In June 2014, to lend better insight on potential clonal structure and spawning synchrony, the project team genotyped ~ 50 colonies of *Orbicella faveolata* from two sites in the FKNMS where the team's previous spawn collections (with variable success) had occurred. Proposed experiments examining effects of both parental identity and water quality on larval swimming and settlement phases of the life history were conducted successfully for two ESA listed species, *A.palmata* and *O.faveolata*. Additional experiments, made possible by good spawning performance and good weather, examined the effects of these same factors on the fertilization step. Sperm from multiple genets were also exposed to different water types and then subjected to SURVEYOR analysis (a DNA damage assay) to detect DNA sequence variation.

#### **Description of accomplishments & results**

Contrary to the team's presumption that clonality was minimal in local patches of *O.faveolata* due to its mounding morphology, one of the two sites genotyped showed a high degree of clonality (ratio of the number of unique genets detected: number of colonies sampled = 0.16). This high clonality likely accounts for occasions of low fertilization success in past years' collections at this site. Pairwise crossing experiments with three parental genets showed a significant effect of the parental cross but no significant effect of water type (Key Largo reef water stored in Teflon, Hollywood sewer outfall boil, and 20 uM ammonia) for fertilization success in both *A.palmata* and *O.faveolata*. This is evidence of substantial incompatibility among concurrently-spawning genets in both these species.

During the larval swimming phase, both species showed significant but variable effects of water type on survivorship, but no significant differences in swimming speed (see Figure below). However, during and settlement phase, both species showed significantly poorer settlement in the 'control' water treatments consisting of local reef water that had been stored in plastic containers. This same water stored in Teflon had significantly higher settlement success for both species (and consistent with results for *A.palmata* from FY13) suggesting that plastic exposure may interfere with complex cues used by coral larvae for settlement.

Overall, while the tested water qualities had some significant effects on swimming larval survivorship and settlement, effects of parental identity were much stronger at the fertilization phase. Thus, the co-occurrence and spawning synchrony of compatible parental genotypes in listed coral populations seems of much greater importance than previously realized. Co-occurrence of adequate numbers of parental genets has long been a concern in Florida Keys *A.palmata* populations, but is in fact much lower than expected in one of two tested *O.faveolata* patches as well.

### **How project supports goals & objectives of CRCP**

This project supports recovery goals for ESA listed species and lends insight to effects of water quality and land based sources of pollution on coral regeneration.

### **How project supports management of coral reef resources**

Reproductive failure is a primary factor in the decline of reef building corals in the Atlantic region. Factors affecting larval production and larval success for spawning corals are important to understand in order to prioritize management actions that might overcome this failure. This project is testing both genetic and water quality factors that may determine the success of spawned coral larvae for ESA listed and proposed species in the Florida Keys. It also contributes to field documentation of coral spawning success in the FKNMS.

### **List of project partners and their roles**

- NCCOS – Performing molecular assays for gamete/larval condition
- Pennsylvania State University – Performing molecular assays for larval genotyping.
- Keys Marine Lab (Cynthia Lewis) - Documenting and collecting coral spawn
- Coral Restoration Foundation - Documenting and collecting coral spawn
- Florida Aquarium - documenting and collecting coral spawn
- FKNMS (Ms. Lauri MacLaughlin) - Coordinating with local dive shops and volunteers, documenting and collecting coral spawn
- Mote Marine Lab - Documenting and collecting coral spawn

### **Communications, media exposure, capacity building, education and outreach activities**

- *O.faveolata* larvae were contributed to support permitted research projects of graduate students at NOVA Southeastern University.

### **Submissions to CoRIS**

See publications below

### **FY2014 Publications**

Miller MW (2014) Post-settlement survivorship in two Caribbean broadcasting corals. *Coral Reefs* 33:1041-1046. DOI 10.1007/s00338-014-1177-7

Miller MW (2014) Quicklook Report: Coral spawning in the upper Florida Keys, Aug-Sept 2014. PRBD-2014-10

[http://data.nodc.noaa.gov/coris/library/NOAA/CRCP/project/797/Quicklook\\_Unpublished\\_Report\\_spawning14.pdf](http://data.nodc.noaa.gov/coris/library/NOAA/CRCP/project/797/Quicklook_Unpublished_Report_spawning14.pdf)

### **FY2014 Presentations**

Cameron & Miller, "Dissolved oxygen and fertilization potential in two reef-building corals". Presentation at Marine Benthic Ecology Meetings, Jacksonville, FL Mar 2014.

### **Setbacks or challenges encountered in FY2014**

None of significance. However, severe thermal bleaching in Florida Keys corals during fall 2014 raise concerns that spawning may be poor in 2015.

### Comments on future direction of project

With the success of the real-time 2-parent crosses attempted in 2014, the funds for genotyping larvae are exhausted. The project team will be attempting more of this type of experiment in 2015, with focus on *O.faveolata* and *A.cervicornis*.



Figure: Example of timed-exposure microscope image (used to quantify swimming speed) showing two *A.palmata* larvae from the water-type experiment. The lower larva was still (not swimming) throughout the five second duration of the exposure. The upper larva appears as a streak with the length of the streak representing the distance it swam during these five seconds. Swimming speed did not differ significantly among larvae of *A.palmata* nor *O.faveolata* that were raised in different water quality types. Millimeter scale shown in the bottom corner of the frame (Photo credit: SEFSC).

<b>Project ID#:</b>	819 – 2014
<b>Title:</b>	Determining Patterns of Staghorn Coral Recovery to Establish Targets for Caribbean Reef Restoration.
<b>PIs and co-PIs:</b>	Margaret Miller (SEFSC) & Brittany Huntington (UM-CIMAS)
<b>Duration of Project:</b>	2 of 2
<b>Project Category:</b>	Other, Protected Corals

#### **Brief description of activities conducted in FY2014**

Field research for FY14 was successfully completed in Florida and Puerto Rico. Monitoring continued at existing *A. cervicornis* study sites in the Dry Tortugas National Park and two new sites were added in Puerto Rico and northern Miami-Dade County, FL. At all three sites, coral density, condition, predation prevalence, and growth were tracked within replicate 20m<sup>2</sup> belt transects spanning a gradient in *A. cervicornis* abundance. Fish community composition was also quantified across the same gradient by counting and estimating the fork length of all fish species observed with the belt transects.

At the Dry Tortugas site, the project team undertook three experiments to investigate the potential for positive feedbacks between the sheltering reef fish community and high density stands of *A. cervicornis*. A macroalgal bioassay was used to determine the relative bioavailability of nutrients in the water surrounding high density versus low density stands of *A. cervicornis*. Wild tissue collections of *A. cervicornis* occurred at these same sites to determine nutrient concentration and zooxanthellae density within colonies, as well as histopathological assessment (by E. Peters, George Mason University). Lastly, a transplant experiment was conducted at these sites to see if higher coral condition could be induced in coral fragments transplanted into the high density *A. cervicornis* site compared to the sparse site. Biological samples and data from these trips are currently being processed.

A scientific manuscript presenting the final results of this study is currently being compiled and will be submitted to a peer-review journal in early 2015.

#### **Description of accomplishments & results**

The project team succeeded in monitoring the *A. cervicornis* population and fish communities at three wild/extant and one restored site in the Caribbean. The results indicate that coral condition varies between the project's four study sites and with the density of *A. cervicornis* conspecifics within a site.

In the Dry Tortugas, the *A. cervicornis* in the densely-populated areas is significantly higher than in other sites characterized with extant *A. cervicornis* 'thickets' (e.g. Flat Cay, USVI). These super-dense stands in the Dry Tortugas exhibit 7% ( $\pm 1.7\%$ ) lower partial mortality, greater colony height ( $3.2 \pm 1.1\text{cm}$ ), and faster branch linear extension ( $3.7 \pm 0.6\text{ cm/yr.}$ ) than nearby sparser stands. These dense "thickets" also support greater biomass ( $71.2 \pm 13.9\text{ g/m}^2$ ), abundance ( $4.3 \pm 0.6\text{ fish/m}^2$ ), and species richness (52.5%  $\pm 11.3\%$ ) of reef fishes. Grunts and other small reef fishes less than 15cm in length were largely responsible for driving these increases. Bioassays and wild collections indicate that both total nitrogen and carbon are more available to fuel primary production in these high density sites compared to sparse *A. cervicornis* sites in the Dry Tortugas. In addition, zooxanthellae density was greater in corals collected at high density sites compared to sparse. Transplant experiment results are still being processed but may add further evidence to this project's hypothesis that greater nutrient availability (from the higher density fish community) confers improved condition (growth, zooxanthellae density, tissue nutrient

concentration) to the coral. These results suggest that restoration efforts may benefit more by outplanting nursery-reared fragments in very dense assemblages, rather than the conventional method of outplanting colonies over a comparatively larger area in a sparser array.

#### **How project supports goals & objectives of CRCP**

This project address a management need articulated in the CRCP FY13 RFP and as well as the ESA mandated NOAA *Acropora* Recovery Plan to “...fill critical information gaps for the recovery of the two currently listed acroporids.”

The primary focus of this project was to address pressing knowledge gaps hindering *A. cervicornis* recovery actions. By studying recovering populations of *A. cervicornis* coral identified in Florida and the US Virgin Islands, as well as an advanced, restored population in Puerto Rico, the project team was able to collect species-specific life history information (growth, mortality, predation and disease prevalence) and determine how colony density and abundance influence the ecological habitat value of this species to reef fishes.

#### **How project supports management of coral reef resources**

The results of this study contribute to best-practices for conducting successful coral restoration by informing restoration site selection, colony outplanting size, and colony outplanting densities to best promote coral resilience and reef fish abundance.

#### **List of project partners and their roles**

- Dry Tortugas National Park (Tracy Ziegler) - In-kind contributing partner including vessel and SCUBA tank usage
- NOAA Office of Habitat Conservation (Tom Moore and Sean Griffin) - collaborative data sharing and logistical support for field sampling in Puerto Rico
- George Mason University (Ester Peters) - collaborator determining histology and pathology of wild collected coral fragments from Dry Tortugas National Park.

#### **Communications, media exposure, capacity building, education and outreach activities**

- Public outreach presentation on the project for visitors at Dry Tortugas National Park, July 2014.

#### **Submissions to CoRIS**

Permit reports for USVI and National Park Service were sent to CoRIS.

#### **FY2014 Publications**

None

#### **FY2014 Presentations**

Marine Benthic Ecology Meeting, Jacksonville FL, Mar 2014. Oral presentation. “Using naturally-recovering staghorn coral (*Acropora cervicornis*) populations to inform restoration and recovery targets”

#### **Setbacks or challenges encountered in FY2014**

Warm water temperatures in August 2014 resulted in partial bleaching of transplanted coral fragments at one of the experimental sites. As samples are still being processed from the experiment, the team is still uncertain how significantly this partial bleaching may have impacted the results.



Obtaining required research permits from Dry Tortugas National Park in a reasonable timeframe was challenging, with the permit arriving the day before the research mission, despite many months of inquiry and negotiation.

#### **Comments on future direction of project**

FY14 is the final year of this project. Final data synthesis and analysis for a manuscript reflecting the outcomes of this two year effort are in process.



Figure: School of grunts above a very dense thicket of *Acropora cervicornis* in the Dry Tortugas National Park (Photo credit: NOAA).

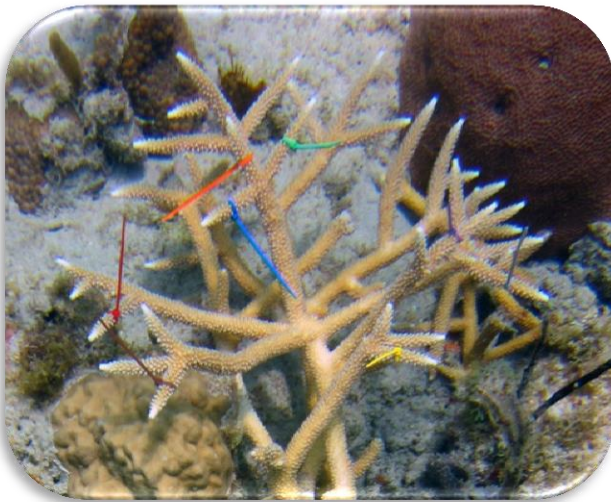


Figure: Replicate tagged branches on an *A. cervicornis* colony for quantifying growth as linear extension over time (Photo Credit: NOAA).



## V. COUNCIL COOPERATIVE AGREEMENT ACTIVITIES

<b>Project ID#:</b>	SAFMC Cooperative Agreement: NA11NMF4410061
<b>Title:</b>	South Atlantic Oculina Experimental Closed Area (OECA) and MPAs: Characterization of Benthic Habitat and Fauna
<b>PIs and co-PIs:</b>	Stacy Harter & Andrew David (SEFSC); John Reed & Stephanie Farrington (FAU/HBOI)
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Council Cooperative Agreement Activities

### **Brief description of activities conducted in FY2014**

The research team completed a research cruise on the NOAA Ship Nancy Foster June 18-27, 2014. The cruise completed Remotely Operated Vehicle (ROV) surveys of the MPAs, proposed MPAs and open-to-fishing areas adjacent to protected areas. The survey is designed to target seven species of deep water grouper and tilefish, but also includes all fish encountered as well as benthic invertebrates. Multibeam sonar mapping was conducted each night to improve habitat mapping and bathymetry.

### **Description of accomplishments & results**

Twenty-nine ROV dives were conducted resulting in a total bottom time of 39.4 hours, covering 25+ km, at depths from 40 to 168 m. A total of 2,429 in situ digital images were taken which included quantitative transect images, general habitat, and species documentation images (as well as 234 still screen grabs made from the High Definition video). Forty-three shipboard CTD casts were made.

A total of 11 multibeam sonar surveys provided new maps covering a total area of 158.14 km<sup>2</sup>, at depths ranging from 45 to 180 m. These sites had never been surveyed previously with multibeam sonar. Georeferenced maps were made for each of the sites and were ground-truthed with the ROV dives.

### **How project supports goals & objectives of CRCP**

This project directly supports management of mesophotic and deep reefs through information provided to SAFMC on target species and habitat in five MPAs between northern Florida and central North Carolina, thus contributing to CRCP Objective F2.5.

### **How project supports management of coral reef resources**

Information provided to SAFMC allows managers to make more informed decisions concerning placement, duration and regulations in existing MPAs within their region of responsibility. Surveys of proposed MPA sites allow Council members to select most beneficial areas for additional protection.

### **List of project partners and their roles**

- Harbor Branch Oceanographic Institute (Reed and Farrington) – Co-principal investigators, leads on benthic invertebrates.
- University of North Carolina at Wilmington, Undersea Vehicles Program (Horn and White) – ROV services.

### **Communications, media exposure, capacity building, education and outreach activities**

None

## Submissions to CoRIS

None

## FY2014 Publications

Reed, J., S. Farrington, S. Harter, and A. David. 2015. South Atlantic MPAs and Deepwater Coral HAPCs: Characterization of Benthic Habitat, Benthic Macrobiota, and Fish Communities. NOAA Ship Nancy Foster Cruise 14-08, FGBNMS Mohawk ROV, June 18-27, 2014. Report to South Atlantic Fishery Management Council. 257 pp.

Harter, S., J. Reed, S. Farrington, and A. David. 2015. South Atlantic MPAs and Deepwater Coral HAPCs: Characterization of Fish Communities, Benthic Habitat, and Benthic Macrobiota. Final Report for 2012-2014 NOAA Cruises with Appendices. Final Report to the South Atlantic Fishery Management Council. 83 pp.

## FY2014 Presentations

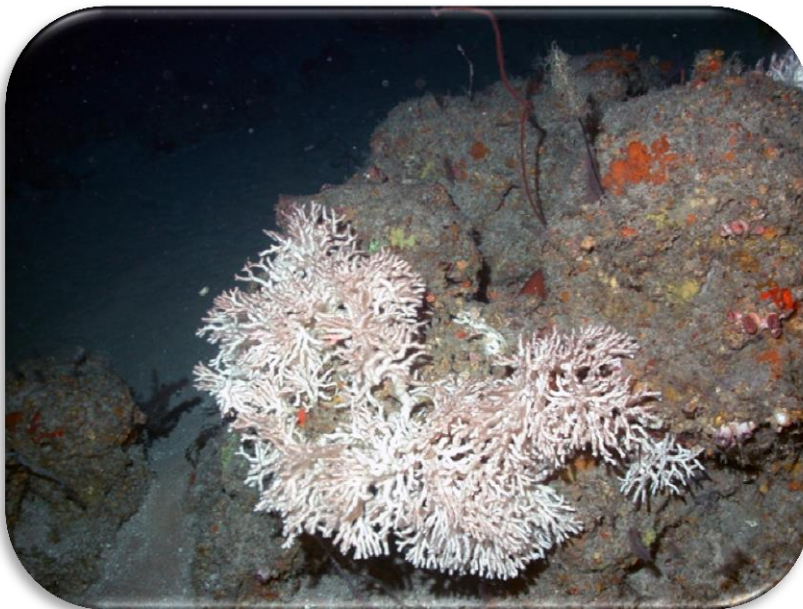
None

## Setbacks or challenges encountered in FY2014

Staffing and repair problems on NOAA Ship Pisces resulted in a shift to the NOAA ship Nancy Foster and the loss of 1/3 planned days at sea.

## Comments on future direction of project

Funding for this project was included in the South Atlantic Council's 2014-2016 Coral Cooperative Agreement. Continued surveys are planned, in coordination with SAFMC, and will be expanded to include surveys and monitoring in and around the *Oculina* Habitat Area of Particular Concern (HAPC) at the Council's request.



Live *Oculina varicosa* colony at 106m in the Snowy Wreck MPA off the coast of North Carolina.

<b>Project ID#:</b>	GMFMC Cooperative Agreement: NA11NMF4410063 2014 UPDATE
<b>Title:</b>	Northeast Gulf of Mexico Reserve Program: Monitoring changes in reef fish populations
<b>PIs and co-PIs:</b>	Andrew David (SEFSC)
<b>Duration of Project:</b>	Funded 2011-2013
<b>Project Category:</b>	Council Cooperative Agreement Activities

#### **Brief description of activities conducted in FY2014**

The project team conducted research cruises aboard the NOAA Research Vessel *Caretta* from February – April 2014. Stereo camera survey of MPAs and adjacent open-to-fishing areas in Northern Gulf of Mexico. These surveys target spawning aggregations of gag grouper (*Mycteroperca microlepis*), but also include all fish encountered and habitat classification.

#### **Description of accomplishments & results**

One hundred thirty four (134) stations were surveyed with a stereo camera array which utilized four separate stereo cameras. Stations were located in the Madison-Swanson MPA, Steamboat Lumps MPA, The Edges MPA and the Twin Ridges open-to-fishing control area. Five cruise legs were required to complete the survey. CTD casts were made at each site.

#### **How project supports goals & objectives of CRCP**

Project directly supports management of mesophotic reefs through information provided to GMFMC on target species and habitat in three MPAs off northern Florida in the Gulf of Mexico, which contributes to CRCP Objective F2.5.

#### **How project supports management of coral reef resources**

Information provided to the GMFMC allows managers to make more informed decisions concerning placement of, duration and regulations in existing MPAs within their region of responsibility.

#### **List of project partners and their roles**

None

#### **Communications, media exposure, capacity building, education and outreach activities**

- Presentation to the GMFMC (see below)

#### **Submissions to CoRIS**

None

#### **FY2014 Publications**

A. David and M. Campbell. 2015. NOAA Fisheries research on Northern Gulf of Mexico MPAs. Report to the Gulf of Mexico Fishery Management Council. 14 pp.

A. David. 2015. NOAA Fisheries research on Northern Gulf of Mexico MPAs. Final Report to the Gulf of Mexico Fishery Management Council. 54 pp.

**FY2014 Presentations**

A. David. 2015. NOAA Fisheries research on Northern Gulf of Mexico MPAs. Presentation to the Gulf of Mexico Fishery Management Council, Ecosystem SSC. 25 February 2015, Tampa, FL.

**Setbacks or challenges encountered in FY2014**

None.

**Comments on future direction of project**

The continuation of this project was not included in the 2014-2016 Gulf of Mexico Council Coral Cooperative Agreement.



Figure: Gag grouper (*Mycteroperca microlepis*) in the Madison-Swanson MPA.